LIST OF CONTENTS

NUMBER 1

P. CHAKRABARTI and B. B. PAL: A new infrared avalanche photodiode for long distance fiber optic communication 1

Y. SASAKI, K. ITOH, E. INOUE, S. KISHI and T. MITSUISHI: A new experimental determination of the relationship between the Hall mobility and the hole concentration in heavily doped p-type silicon 5

J. D. WOODHOUSE, J. P. DONNELLY and G. W. ISELER: Electrical properties of Fe-doped semi-insulating InP after proton bombardment and annealing 13

I. BLOOM and Y. NEMIROVSKY: Bulk levels and interface calculations for narrow band-gap semiconductors 17

F. BAUER, S. C. JAIN, J. KOREC, V. LAUER, M. OFFENBERG and P. BALK: Incompatibility of requirements for optimizing short channel behaviour and long term stability in MOSFETs 27

HSUN-HUA TSENG and CHING-YUAN WU: The effects of thermal silicidation on the current transport characteristics of Ti/⟨111⟩Si Schottky-barrier contacts .. 35

NADEEM S. ALVI and IRVING KAUFMAN: The ESFET—an evaporated chemical-sensing field-effect transistor 45

J. KASSABOV, D. DIMITROV and A. GRUEVA: Acceptor states at the Si–SiO_2 interface generated by UV and their effect on electron mobility 49

T. CLARYSSE and W. VANDERVORST: An efficient smoothing algorithm for spreading resistance calculations 53

ANTONIO LUQUE: Analysis of high efficiency back point contact silicon solar cells 65

J. J. LIOU: Non-quasi-static capacitance of P/N junction space-charge regions 81

N. BRUTSCHER and M. HOHEISEL: Schottky diodes with high series resistance: a simple method of determining the barrier heights 87

A. ZEKRY and G. ELDALLAL: Effect of MS contact on the electrical behaviour of solar cells 91

A. MODELLI and S. MANZINI: High-field drift velocity of electrons in silicon inversion layers 99

G. GHIBAUDO and F. BALESTRA: Modelling of ohmic MOSFET operation at very low temperature 105

TAN FU LEI and GUANG KAI JENG: The Pd–Zn system for ohmic contacts to p-type GaP 109

FRANCISZEK GRABOWSKI: Influence of the interface and of the channel volume on $1/f$ noise of MOS transistors biased in the linear region at strong inversion 115

Notes

L. Shankar Narayanan, A. B. Bhattacharyya and Sudhir Chandra: A simple high-frequency characterization of a three-phase CCD by controlled free-charge transfer 121

P. Canfield and L. Forbes: Lateral n–p–n bipolar transistors by ion implantation into semi-insulating GaAs 123

Software Survey Section I

NUMBER 2

J. B. Boos and W. Kruppa: Low-resistance AuZn gate ohmic contacts for InP JFETs 127

T. D. Davis and L. M. Rucker: A model for excess base noise in bipolar junction transistors 135

P. Chattopadhyay and V. Kumar: Experimental investigation of the dependence of barrier height on metal work function for metal–SiO_2–p–Si (MIS) Schottky-barrier diodes in the presence of inversion 143

J. Kassabov, E. Atanassova, D. Dimitrov and E. Goranova: Argon plasma treatment effects on Si–SiO_2 structures 147

J. Y. Lee, W. M. Clark and M. W. Utlaut: Multiple-threshold-voltage CMOS/SOS by focused ion beams 155

R. Kachare, B. E. Anspaugh and G. F. J. Garlick: Tunneling effects in the current–voltage characteristics of high-efficiency GaAs solar cells 159

X. Wu, H. L. Evans and E. S. Yang: An improved differential voltage technique for capacitance measurement 167

E. A. Hendriks and R. J. J. Zijlstra: Diffusion and inter-valley noise in (100) n-channel Si-MOSFETs from $T = 4.2$ to 295 K 171

G. A. Hawkins: Generation currents from interface states in selectively implanted MOS structures 181

Fredrik A. Lindholm and C. Tang Sah: Circuit technique for semiconductor-device analysis with junction diode open circuit voltage decay example 197

F. Scholz, J. M. Hwang and D. K. Schroder: Low frequency noise and DLTS as semiconductor device characterization tools 205

D. K. Gautam, W. S. Khokle and K. B. Garg: Photon emission from reverse-biased silicon p–n junctions 219

Fumio Hasegawa, Masaaki Onomura, Chikako Mogi and Yasuo Nannichi: Reduction of Schottky barrier heights by surface oxidation of GaAs and its influence on DLTS signals for the midgap level EL2 223

Cheng T. Wang: An improved hot-electron-emission model for simulating the gate-current characteristic of MOSFETs 229

A. H. PAWLIKIEWICZ, A. VAN DER ZIEL, G. S. KOUSIK and C. M. VAN VLIET: On the temperature dependence of the Hooge parameter α_H in n and p-channel silicon JFETs 233

WEI TONGLI and HE YIE: Computer analysis and design optimization of magnetic-field sensitive MOS device 237

ZEYNEP CELIK-BUTLER and THOMAS Y. HSIANG: Spatial correlation measurements of $1/f$ noise in semiconductors 241

E. AVNI, Y. SONNENBLICK and Y. NISSAN-COHEN: The effect of gate material on oxide degradation due to charge-injection in metal-oxide-semiconductor capacitors 245

M. C. WU, Y. K. SU, K. Y. CHENG and C. Y. CHANG: Electrical and optical properties of heavily doped Mg– and Te–GaAs grown by liquid-phase epitaxy 251

J. SZATKOWSKI and K. SIERAŃSKI: Interface effects on Mg–Zn_3P_2 Schottky diodes 257

G. SH. GILDENBLAT and S. S. COHEN: Criteria for estimating the impact of series resistance on MOSFET performance 261

R. KINDER and H. FRANK: Determination of doping profiles for low boron ion implantations in silicon 265

M. EL BANNA and M. EL NOKALI: A pseudo-two-dimensional analysis of short channel MOSFETs 269

R. S. FYATH and J. J. O'REILLY: Effective gain and effective excess noise factor associated with dark current in superlattice APDs 275

F. HOFMAN, R. J. J. ZIJLSTRA and J. C. M. HENNING: Current noise in N-type $Al_xGa_{1-x}As$ 279

FRANÇOIS HÉBERT and DAVID J. ROULSTON: Base resistance of bipolar transistors from layout details including two dimensional effects at low currents and low frequencies 283

M. J. DEEN: Operational characteristics of CMOS op-amps at cryogenic temperatures 291

C. P. PLEASE and J. R. KING: One- and two-dimensional nonlinear dopant diffusion in crystalline silicon—some analytical results 299

Notes

F. J. GRACIA and A. IBARRA: High current dependence of base series resistance of bipolar transistors 307

K. BHATTACHARYYA and P. K. BASU: Alloy scattering mobility of two dimensional electron gas in rectangular and delta doped quantum wells in quaternaries 309

ALAN G. SOLHEIM and DAVID J. ROULSTON: Computed noise performance of optimized JFETs as front ends in fiber-optic preamplifiers 311

J. G. SIMMONS and G. W. TAYLOR: A comparison of minimum propagation delay and unity power transfer frequency of submicron MOSFETs 314

SOFTWARE SURVEY SECTION I

NUMBER 3/4

SPECIAL ISSUE

HOT CARRIERS IN SEMICONDUCTORS

Foreword ix

Committees and Sponsors xi

Conference Photograph xiii

Opening Address xv

Chapter I Real Space Transfer/Heterostructures

Real Space Transfer: Generalized Approach to Transport in Confined Geometries 319
K. Hess *(Invited Paper)*

Real Space Hot Electron Distributions and Transfer Effects in Heterostructures 325
Y. Cho, R. Sakamoto and M. Inoue

Microscopic High Field Transport in Graded Heterostructures 329
A. Al-Omar and J. Krusius

Monte-Carle Study of the Double Heterojunction Bipolar Transistor 333
J.-L. Pelouard, P. Hesto and R. Castagne

Electron Velocity at High Electric Fields in AlGaAs/GaAs Modulation-Doped Heterostructures 337
W. Masselink, N. Braslau, D. LaTulipe, W. Wang and S. Wright

Hot Carrier Trapping in GaAs/AlGaAs Single Quantum Wells with Different Confinement Structures 341
H.-J. Polland, K. Leo, K. Ploog, J. Feldmann, G. Peter, E. Göbel, K. Fujiwara and T. Nakayama

Collective Electron Interaction in Double-Barrier GaAs Transistors 345
V. Gruzinskis, S. Kersulis, R. Mickevicius, J. Pozela and A. Reklaitis

Simulations of Nonlinear Transport in AlGaAs/GaAs Single Well Heterostructures 349
K. Kim, K. Hess and F. Capasso

Real Space Transfer of Two Dimensional Electrons in Double Quantum Well Structures 351
N. Sawaki, M. Suzuki, E. Okuno, H. Goto, I. Akasaki, H. Kano, Y. Tanaka and M. Hashimoto

Ensemble Monte Carlo Simulation of Real Space Transfer (NERFET/CHINT) Devices 355
I. Kizilyalli, K. Hess, T. Higman, M. Emanuel and J. Coleman

Effect of Continuum Resonances on Hot Carrier Transport in Quantum Wells 359
W. Porod and C. Lent

On the Analytical Approach to the Real Space Electron Transfer in GaAs-AlGaAs Heterostructures 363
M. Mosko, I. Novak and P. Quittner

Diffusion Coefficients of Two-Dimensional Electron Gas in Heterojunctions 367
J. Zimmermann and Y. Wu

Hot Electron Distribution and Transport in AlGaAs/GaAs/AlGaAs Quantum Wells 371
K. Makiyama, M. Inoue, M. Ashida, Y. Cho, Y. Iwai, S. Sasa and S. Hiyamizu

Reduced Intervalley Transfer in a GaAs-AlGaAs Heterojunction 375
K. Nederveen and T. van de Roer

Ultrafast S-Type NDC and Self-Oscillations Under Vertical Transport in Multilayer Heterostructures 379
A. Belyantsev, V. Gavrilenko, A. Ignatov, V. Piskarev, V. Shashkin and A. Andronov

Electron Transport in GaAs/$Al_xGa_{1-x}As$ Heterojunctions at Low Temperatures 383
M. Artaki and K. Hess

Magnetic Field-Dependent Hot Carrier Relaxation in GaAs Quantum Wells 387
A. Turberfield

Warm Electron Coefficient of Two Dimensional Electron Gas in a GaAs-AlGaAs Heterojunctions at Low Temperatures 391
P. Basu and K. Bhattacharyya

Chapter 2 Ultrafast Studies

Femtosecond Spectroscopy and Transport *(Invited Paper)* 397
C. Shank

Ultrafast Relaxation of Hot Photoexcited Carriers in GaAs 401
D. Ferry, M. Osman, R. Joshi and M.-J. Kann

Heating of Cold Electrons by a Warm GaAs Lattice: A Novel Probe to Carrier-Phonon Interaction *(Invited Paper)* 407
W. Rühle, H.-J. Polland, E. Bauser, K. Ploog and C. Tu

Intersubband Relaxation of Photoexcited Hot Carriers in Quantum Wells 413
D. Oberli, D. Wake, M. Klein, T. Henderson and H. Morkoc

Secondary Emission Studies of Hot Carrier Relaxation in Polar Semiconductors 419
J. Kash and J. Tsang *(Invited Paper)*

High Density Femtosecond Excitation of Nonthermal Carrier Distributions in Intrinsic and Modulation Doped GaAs Quantum Wells *(Invited Paper)* 425
W. Knox, D. Chemla and G. Livescu

Hot Carrier Energy Loss Rates in GaInAs/InP Quantum Wells 431
D. Westland, J. Ryan, M. Scott, J. Davies and J. Riffat

Initial Relaxation of Photoexcited Carriers in GaAs and GaAs Quantum Wells Under Subpicosecond Excitation 435
B. Deveaud, J. Shah, T. Damen, A. Gossard and P. Lugli

Femtosecond Relaxation Dynamics of Nonequilibrium Carriers in GaAs and Related Compounds 439
C. Tang, F. Wise and I. Walmsley

Femtosecond Hot Carrier Energy Redistribution in GaAs and AlGaAs 443
R. Schoenlein, W. Lin, S. Brorson, E. Ippen and J. Fujimoto

Hot Carrier Relaxation in Highly Excited III-V Compounds 447
H. Kurz, W. Kuett, K. Seibert and M. Strahnen

Nonequilibrium Phonon Effects on the Time-Dependent Relaxation of Hot Carriers in GaAs MQW 451
K. Shum, M. Junnarkar, H. Chao, R. Alfano and H. Morkoc

Picosecond Raman Scattering from Non-Equilibrium LO and TO Phonons in Germanium 455
J. Young, K. Wan and H. van Driel

Energy Relaxation in p- and n-GaAs Quantum Wells: Confinement Effects 459
M. Tatham, R. Taylor, J. Ryan, W. Wang and C. Foxon

Electron-Electron Scattering During Femtosecond Photoexcitation in Quantum Wells 463
S. Goodnick and P. Lugli

Ensemble Monte Carlo Simulations of Femtosecond Energy Relaxation of Photoexcited Electrons in Bulk GaAs 467
D. Bailey, C. Stanton, M. Artaki, K. Hess, F. Wise and C. Tang

Carrier-Carrier Interaction and Intervalley Transfer Effects on the Ultrafast Relaxation of Photoexcited Electrons in GaAs 471
M. Osman and H. Grubin

Chapter 3 Optical Studies

Hole-Acoustic Phonon Energy Loss Rates in GaAs Quantum Wells Determined by Light Scattering 477
A. Pinczuk, J. Shah and A. Gossard

Hot Carrier Relaxation Phenomena Detected by Optically Induced Magnetization 481
H. Krenn, K. Kaltenegger and G. Bauer

High Resolution Studies of 2 D Plasma Transport in GaAs/GaAlAs Quantum Wells 485
H. Hillmer, A. Forchel, S. Hansmann, E. Lopez and G. Weimann

Energy and Spin Polarization Analysis of Near Band Gap Photoemission in AlGaAs/GaAs Heterostructures 489
F. Ciccacci, H.-J. Drouhin, C. Hermann, R. Houdre, G. Lampel and F. Alexandre

Laser Induced Cooling of Hot Electrons in n-InSb by Free Carrier Assisted Transitions 493
L. Hanes and D. Seiler

Transport in Photoexcited Hot Carriers Systems 497
V. Freire, A. Vasconcellos and R. Luzzi

Hot Electron Energy Relaxation Via Acoustic Phonon Emission in InP/$In_{0.53}Ga_{0.47}As$ Heterostructures and Single Quantum Wells 501
M. Barlow, B. Ridley, M. Kane and S. Bass

Hot Carrier Relaxation and Recombination in GaSb/AlSb Quantum Wells 507
U. Cebulla, S. Zollner, A. Forchel, S. Subbanna, G. Griffiths and H. Kroemer

Nonlinear Modulation of Hot Carrier Mobility and Optical Absorption in Photoexcited Polar Semiconductors 511
M. Rodriguez and J. Carrillo

Chapter 4 Transport Theory

Quantum Transport and Solid-State Dynamics for Bloch Electrons in an Electric Field 517
G. Iafrate and J. Krieger

A New Monte Carlo Technique for the Solution of the Boltzmann Transport Equation 523
C. Jacoboni, P. Poli and L. Rota

Analysis of Quantum Features in Transport Theory from a Quantum Monte Carlo Approach 527
R. Brunetti and C. Jacoboni

Nonequilibrium Phonon Effects on Hot Carrier Transport and Thermal Noise in Semiconductor Heterostructures 531
X. Lei and N. Horing

Quantum Corrections to the Monte Carlo Solution of Hot-Electron Transport in Semiconductors 535
A.-P. Jauho and L. Reggiani

Nonlinear Energy Relaxation Oscillations and Chaotic Dynamics of Hot Carriers 539
E. Schöll

Generation-Recombination Noise of Hot Carriers in Semiconductors 543
L. Reggiani, P. Lugli and V. Mitin

A New Monte Carlo Simulation of Hot Electron Transport with Electron-Electron Scattering 547
A. Hasegawa, K. Miyatsuji, K. Taniguchi and C. Hamaguchi

Balance Equation Approach to Hot Electron Transport in Many-Valley Semiconductors: Comparing with the Monte Carlo Results for n-Type Si 551
C. Ting, M. Liu and D. Xing

Ballistic Electron Transport in GaAs/AlGaAs Tunneling Junctions with Optical Phonon Emission 555
P. Hu and C. Ting

A Generalization of Kubo Formalism for Hot-Electron Transport 559
J. Niez, P. Lugli and L. Reggiani

Feynman Path Integral Study of Confined Carriers Subject to a Statistical Potential 563
L. Register, M. Littlejohn and M. Stroscio

Transport Correlation Coefficients and Photoconductive Switching 567
R. Grondin and M.-J. Kann

Hydrodynamic Hot-Electron Transport Model with Monte Carlo-Generated Transport Parameters 571
D. Woolard, R. Trew and M. Littlejohn

Chapter 5 Devices

Resonant-Tunneling Hot Electron Transistor (RHET) *(Invited Paper)* 577
N. Yokoyama, K. Imamura, H. Ohnishi, T. Mori, S. Muto and A. Shibatomi

High Field Hot Electron Transport Through $Al_xGa_{1-x}As$ Multiquantum Well Superlattices *(Invited Paper)* 583
B. Levine, K. Choi, C. Bethea, J. Walker and R. Malik

Theoretical and Experimental Investigations of the Heterostructure Hot Electron Diode *(Invited Paper)* 589
M. Emanuel, T. Higman, J. Higman, J. Kolodzey, J. Coleman and K. Hess

The Effect of Reflecting Contacts on High Field Transport 593
D. Arnold and K. Hess

The Submicron Inverted MODFET l-GaAs/N^+-AlGaAs: A 2D Monte-Carlo Study 595
R. Fauquembergue, J. Thobel, P. Descheerder, M. Pernisek and P. Wolf

The Influence of Cathode Contacts on Near-Micron InP Transferred Electron Devices 599
J. Czekaj and M. Shaw

Extremely Enhanced I-V Collapse of n^+-$Al_xGa_{1-x}As$ / GaAs MODFET with AlAs Mole Fraction x Higher Than 0.4 603
T. Kobayashi, N. Okisu, T. Takahashi, Y. Yoshizako, T. Tomita, T. Yamashita and T. Sakurai

Double Ridley-Watkins-Hilsum-Gunn Effect in Compensated GaAs 607
J. Xu and M. Shur

Chapter 6 Ballistic Transport

The Use of Linearly Graded Composition AlGaAs Injectors for Intervalley Transfer in GaAs: Theory and Experiment 613
N. Couch, P. Beton, M. Kelly, T. Kerr, D. Knight and J. Ondria

Ballistic Transport *(Invited Paper)* 617
M. Heiblum

Hot Electron Dynamics in Device Structures *(Invited Paper)* 619
J. Hayes

Room Temperature Operation of Unipolar Hot Electron Transistors 625
A. Levi and T. Chiu

Hot Electrons in SiO_2: Ballistic to Steady-State Transport *(Invited Paper)* 629
M. Fischetti and D. DiMaria

Monte-Carlo Simulation of Hot Electron Spectra 637
P. Beton, A. Long and M. Kelly

Chapter 7 Scattering Processes and Hot Phonons

Electron-Hole Drag in Semiconductors *(Invited Paper)* 643
R. Höpfel and J. Shah

Interaction Between Layers by Electron-Electron Scattering 649
C. Jacoboni and P. Price

Monte Carlo Investigation of Minority Electron Transport in $In_{0.53}Ga_{0.47}As$ 653
M. Osman and H. Grubin

Scattering Processes in Semiconductors *(Invited Paper)* 657
M. Combescot

The Effects of Band Structure on Electron-Hole Coulomb Scattering 663
J. Young, P. Kelly and N. Henry

Hot Phonon Dynamics *(Invited Paper)* 667
P. Lugli

Hot Phonons in GaAs Revisited 673
W. Pötz, M. Osman and D. Ferry

Nonequilibrium Carrier-Phonon Coupling in a Semiconductor Quantum Well *(Invited Paper)* 677
M. Marchetti, W. Cai and M. Lax

The Effect of Hot Phonons and Coupled Phonon-Plasmon Modes on Scattering-Induced NDR in Quantum Wells 683
B. Ridley and M. Al-Mudares

Transient Hot-Phonon Effects on the Velocity Overshoot of GaAs: A Monte Carlo Analysis 687
M. Rieger, P. Kocevar, P. Bordone, P. Lugli and L. Reggiani

Inverted Populations of Hot Electrons in a Magnetic Field: The Effects of Electron-Electron and Impurity Scattering in n-GaAs 691
F. Abou El-Ela and B. Ridley

Hot Electron Relaxation in Polar Semiconductors *(Invited Paper)* 695
S. Das Sarma, J. Jain and R. Jalabert

Electron Gas Heating and Cooling Effects by Microwave Electric Fields in Compensated InSb 701
S. Asmontas, J. Pozela, L. Subacius and G. Valusis

Chapter 8 Tunneling

Magnetic Field Studies of Negative Differential Conductivity in Double Barrier Resonant Tunneling Structures Based on n⁻InP/(InGa)As 707
M. Leadbeater, L. Eaves, P. Simmonds, G. Toombs, F. Sheard, P. Claxton, G. Hill and M. Pate

Electron Tunnelling Into Interfacial Landau States in Single Barrier N-Type (InGa)As/InP/(InGa)As Heterostructures *(Invited Paper)* 711
K. Chan, L. Eaves, D. Maude, F. Sheard, B. Snell, G. Toombs, E. Alves, J. Portal and S. Bass

Electron Tunneling From Donors and Excitons *(Invited Paper)* 717
A. Dargys and A. Matulionis

Resonant Tunneling Through Quantum Wells: Physics and Device Applications *(Invited Paper)* 723
F. Capasso, S. Sen, A. Cho, A. Gossard and R. Spah

Breakdown of Coherence in Resonant Tunneling Through Double-Barrier Heterostructures 731
V. Goldman, D. Tsui and J. Cunningham

Tunneling Studies of the Miniband Structure of a Superlattice 735
P. England, J. Hayes, J. Harbison and D. Hwang

Quantum Transport Modeling of Resonant-Tunneling Devices 739
W. Frensley

Quantum Tunneling Properties From a Wigner Function Study 743
N. Kluksdahl, A. Kriman, C. Ringhofer and D. Ferry

Tunneling Times for Wave Packets Narrow in Wave-Number Space 747
E. Hauge, J. Falck and T. Fjeldly

Chapter 9 Far Infrared and Magnetic Field Studies

Analysis of Carrier Distribution Function Through Smith-Purcell Effect in GaAs/GaAlAs Heterostructures 751
E. Gornik, R. Christanell, R. Lassnig, W. Beinstingl, K. Berthold and G. Weimann

Far IR Luminescence of Hot Holes in Ge: Diagnostics of Intersubband Population Inversion and Effects of Uniaxial Stress 755
V. Gavrilenko, A. Korotkov, Z. Krasyl'nik, V. Nikonorov and S. Pavlov

New Results on Stimulated Emission From p-Germanium in Crossed Fields 759
M. Helm, K. Unterrainer, E. Gornik and E. Haller

Investigations of Recombination Mechanisms in the Pulsed Far Infra Red Photoresponse of n-InP 763
G. Rikken, P. Wyder, J. Chamberlain, D. Halliday and R. Grimes

Direct Observation of Intersubband Relaxation in Narrow Multiple Quantum Well Structures 767
A. Seilmeier, H.-J. Hübner, M. Wörner, G. Abstreiter, G. Weimann and W. Schlapp

Normal and Hot Electron Magneto-Phonon Resonance in a GaAs-Heterostructure 771
P. Warmenbol, F. Peeters and J. Devreese

Electric Field-Induced Magnetophonon Resonance 777
N. Mori, N. Nakamura, K. Taniguchi and C. Hamaguchi

Measurements of Hot Electron Magnetophonon Resonance in GaAs/GaAlAs Heterostructures 781
D. Leadley, M. Brummell, R. Nicholas, J. Harris and C. Foxon

Hot Electron Transport Parallel to Strong Magnetic Fields in Gallium Arsenide 785
E. Hellman and J. Harris, Jr.

Chapter 10 Impact Ionization/Noise/Chaos

Impact Ionization and Electric Field Quenching of Photoluminescence in Silicon 791
H. Weman, Q. Zhao and B. Monemar

Impact Ionization and Chaotic States in Narrow-Gap Semiconductors Under a Strong Magnetic Field 795
Y. Abe

Hot Electron Capture in GaAs MQW: NDR and Persistent Effects 799
N. Balkan, B. Ridley and J. Roberts

Quantitative Characterization of Chaotic Current Oscillations in GaAs:Cr 805
J. Pozela, A. Tamasevicius and J. Ulbikas

Chaotic Conductivity Oscillation in N-Type Si by Impact-Ionization in Freezeout Temperature Range 809
K. Yamada, N. Takara, H. Imada, N. Miura and C. Hamaguchi

Low Frequency and Chaotic Current Oscillations in Semiinsulating GaAs 813
W. Knap, M. Jezewski, J. Lusakowski and Kuszko

Spatio-Temporal Instabilities in the Electric Breakdown of P-Germanium 817
J. Peinke, J. Parisi, B. Röhricht, K. Mayer, U. Rau and R. Huebener

Author Index I

Attendees List V

NUMBER 5

A. KUSY and E. LISTKIEWICZ: Percolation network for thick resistive films..... 821

A. H. PAWLIKIEWICZ, A. VAN DER ZIEL, G. S. KOUSIK and C. M. VAN VLIET: Fundamental $1/f$ noise in silicon bipolar transistors 831

M. SARITAS and H. D. MCKELL: Diffusion length studies in silicon by the surface photovoltage method 835

D. MOY, S. BASAVAIAH, C. T. CHUANG, G. P. LI, E. HACKBARTH, S. B. BRODSKY and M. R. POLCARI: Effects of processing conditions on the characteristics of platinum silicide Schottky barrier diodes 843

D. D. COON and A. G. U PERERA: Neuron-like transient phenomena in silicon p–i–n structures 851

S. R. COCHRAN and T. K. GUSTAFSON: The optoelectronic response of an MIS-type tunnel-emitter transistor 863

MICHAEL R. TROCINO, KUAN-YU FU and KER-WEN TENG: Stress-bias dependence of hot-carrier-induced degradation in MOSFETs..... 873

K. KIM and K. HESS: Ensemble Monte Carlo simulation of semiclassical nonlinear electron transport across heterojunction band discontinuities 877

J.-L. COPPEE and F. VAN DE WIELE: SILO isolation technique: a study of active and parasitic device characteristics with semi-recessed and fully-recessed field oxides..... 887

C. JINDAL and P. PANAYOTATOS: A concise and complete solution for linearly graded p–n junctions 893

A. Benarab, H. Baudrand, M. Lescure and J. Boucher: An accurate two-dimensional LBIC solution for bipolar transistors 899

Wieslaw Kuzmicz and Wanda Zagozdzon-Wosik: Heavy doping parameters estimated from transistor measurements 911

P. Krispin, G. Beister and J. Maege: The isotype $Al_{0.05}Ga_{0.95}As/Al_{0.35}Ga_{0.65}As$ interface of the LPE-grown double heterostructure at elevated temperature 921

Yeu-Haw Yang, Chung-Yu Wu and Wen-Yang Chen: A new method for determining the terminal series resistances and high-injection coefficient of bipolar transistors in CMOS integrated circuits for computer-aided circuit modeling 929

T. E. Hof, T. J. Morthorst and K. P. Roenker: Measurement of generation lifetime in thin silicon layers 937

W. De Bosscher, R. L. Van Meirhaeghe, A. De Laere, W. H. Laflère and F. Cardon: A study of the electrical and interfacial properties of sputtered Ti/Si and sputtered $TiSi_2$/Si Schottky barriers 945

Y. K. Su, T. A. Dai and S. C. Chen: Effect of the InP doping density on the electrical properties of the two-dimensional electron gas in LPE-grown modulation-doped heterostructures 953

Charles Surya and Thomas Y. Hsiang: A thermal activation model for $1/f^{\gamma}$ noise in Si-MOSFETs 959

Staffan Gustafsson and Christer Svensson: An analytical model for a vertical metal base transistor operated in the bipolar mode 965

Arkadiusz Cetner, Krzysztof Iniewski and Andrzej Jakubowski: A simple formula for two-dimensional capacitance 973

S. Dimitrijev, N. Stojadinović and Z. Stamenković: Yield model for in-line integrated circuit production control 975

James M. Noras: Parameter estimation in MOS conductance studies 981

R. E. Jones and R. A. Abram: Hot hole creation due to impact excitation in the metal electrode of a forward biased MIS structure 989

Note

Umesh Kumar: Modified charge-control model for MOS transistors in pre-saturation region 999

Software Survey Section I

NUMBER 6

Charles Ching-Hsiang Hsu and C. Tang Sah: Generation–annealing of oxide and interface traps at 150 and 298 K in oxidized silicon stressed by Fowler–Nordheim electron tunneling 1003

STEVE SHAO-SHIUN CHUNG and CHIH-TANG SAH: Threshold voltage models of the narrow-gate effect in micron and submicron MOSFETs 1009

M. MEYYAPPAN, J. P. KRESKOVSKY and H. L. GRUBIN: Numerical simulation of an AlGaAs/GaAs bipolar inversion channel field effect transistor 1023

ROBERT B. DARLING: High-field, nonlinear electron transport in lightly doped Schottky-barrier diodes 1031

M. M. JEVTIĆ: Impurity concentration dependence of the $1/f$ noise parameter α in silicon 1049

KRISHNA K. PARAT and SORAB K. GHANDHI: Sulphur diffusion into InP by an open tube process 1053

CHIEN NGUYEN-DUC, SORIN CRISTOLOVEANU and GÉRARD GHIBAUDO: A three-piece model of channel length modulation in submicrometer MOSFETs 1057

M. NEDJALKOV and P. VITANOV: Monte–Carlo methods for determination of transport properties of semiconductors 1065

W. L. GUO, M. K. MORAVVEJ-FARSHI and M. A. GREEN: High temperature lifetesting of silicon metal-thin insulator–semiconductor heterojunction emitter bipolar transistors 1071

HISHAM HADDARA and GÉRARD GHIBAUDO: Analytical modeling of transfer admittance in small MOSFETs and application to interface state characterisation 1077

S. J. BATTERSBY, F. M. SELTEN, J. J. HARRIS and C. T. FOXON: Magnetoresistance effect in AlGaAs/GaAs two-dimensional electron gas structures at room temperature 1083

N. GOLDSMAN and J. FREY: Electron energy distribution for calculation of gate leakage current in MOSFETs 1089

V. N. BRUDNYI, V. I. GAMAN and V. M. DIAMOND: Effect of deep levels induced by electron irradiation upon the charge transport mechanism and the pressure-dependent electrical properties of forward-biased p^+–n–n^+ GaAs diodes 1093

L. A. DELIMOVA, YU. V. ZHILYAEV, V. YU. KACHOROVSKY, M. E. LEVINSHTEIN and V. V. ROSSIN: Forward current–voltage characteristics of gallium arsenide power diodes at high current densities 1101

E. A. HENDRIKS and R. J. J. ZIJLSTRA: $1/f$ Noise in (100) n-channel Si-MOSFETs from $T = 4.2$ K to $T = 295$ K 1105

SEOG-JU OH and Y. T. YEOW: A modification to the Fowler–Nordheim tunneling current calculation for thin MOS structures 1113

Note

D. K. GAUTAM, W. S. KHOKLE and K. B. GARG: Effect of absorption on photon emission from reverse-biased silicon P–N junctions 1119

SOFTWARE SURVEY SECTION I

NUMBER 7

Special Honour Issue for Dr W. Crawford Dunlap on the occasion of his 70th birthday

Robert Maxwell: Foreword v

Biographical Sketch ix

Publications and Patents xi

Tributes xv

I. S. LEYBOVICH and D. L. RODE: Persistent photoconductivity in free-standing layers of *n*-AlGaAs 1123

D. E. BURK and S.-Y. YUNG: Experimental verification of the extended-emitter concept for phosphorus-implanted self-aligned polysilicon-contacted bipolar transistors 1127

S.-Y. YUNG and D. E. BURK: Informed device design and gain-speed trade-off for self-aligned polysilicon-emitter transistors 1139

WALLACE WAN-LI LIN and CHIH-TANG SAH: Effects of hydrogen chloride on the annealing kinetics of interface and oxide traps in oxidized silicon stressed by avalanche electron injection 1151

S. NOOR MOHAMMAD and CHARLES E. ROGERS: Theory of electrical transport and recombination in polycrystalline semiconductors under optical illumination 1157

W. COX and E. J. BAILEY: Semi-analytical treatment of electron transport in the presence of an electric field 1169

A. EL-EMAWY, A. ZEKRY, M. EL-KOOSY and H. FIKRY: Properties of diffused resistors in solar-grade semicrystalline silicon 1179

M. S. LEONG, S. C. CHOO, L. S. TAN and T. L. GOH: Contact resistance calculations based on a variational method 1187

M. TABIB-AZAR: Characterization of electrical properties of semi-insulating GaAs using acousto-electric voltage spectroscopy between 83 and 300 K with surface wave power as an additional parameter 1197

ALDERT VAN DER ZIEL: The experimental verification of Handel's expressions for the Hooge parameter 1205

Z. GREENWALD, D. W. WOODARD, A. R. CALAWA and L. F. EASTMAN: The effect of a high energy injection on the performance of mm wave Gunn oscillators 1211

MUNECAZU TACANO, YOSHINOBU SUGIYAMA, TAKASHI TAGUCHI and HAJIME SOGA: Low-frequency noise in GaAs layers grown by molecular beam epitaxy 1215

SOFTWARE SURVEY SECTION I

NUMBER 8

Editorial Report i

S. NOOR MOHAMMAD and CHARLES E. ROGERS: Current–voltage characteristics and performance efficiency of polysilicon solar cells 1221

M. A. KHALIQ, Q. A. SHAMS, W. D. BROWN and H. A. NASEEM: Memory characteristics of MNOS capacitors fabricated with PECVD silicon nitride 1229

FRANÇOIS HÉBERT and DAVID J. ROULSTON: Computation of the base resistance of bipolar transistors from layout details including quasi three-dimensional effects 1235

MUNECAZU TACANO, KINYA OIGAWA and YOSHINOBU SUGIYAMA: $1/f$ Noise in ion-implanted indium phosphide layers 1243

G. W. WANG, Y. K. CHEN, L. F. EASTMAN and B. WHITEHEAD: Reduction of gate resistance in tenth-micron gate MODFETs for microwave applications 1247

D. G. IVEY, R. BRUCE and G. R. PIERCY: Transmission/scanning transmission electron microscopy investigation of Au/Cr contacts to p-type InP 1251

K. INIEWSKI and A. JAKUBOWSKI: A new method for the determination of channel depth and doping profile in buried-channel MOS transistors 1259

W. I. KHAN: Some interesting characteristics of GaAs vertical p^+in^+ diodes .. 1265

G. A. M. HURKX: A new approach to a.c. characterization of bipolar transistors 1269

ANDREW K. JONSCHER and MARK N. ROBINSON: Dielectric spectroscopy of silicon barrier devices 1277

HISHAM S. HADDARA and MOHAMED EL-SAYED: Conductance technique in MOSFETs: study of interface trap properties in the depletion and weak inversion regimes 1289

M. J. DEEN: Cryogenic temperature dependence of the voltage transfer characteristics of CMOS inverters 1299

J. J. MAREŠ, J. KRIŠTOFIK, V. ŠMÍD and F. DEML: On space-charge-limited conduction in semi-insulating GaAs 1309

Z. KACHWALLA: Characterizing traps in MESFETs using internal transconductance (g_m) frequency dispersion 1315

JAU HWANG HO, CHUNG LEN LEE and TAN FU LEI: Error reduction in the ellipsometric measurement on thin films 1321

P. DANSAS, M. BOUCHEMAT, C. BRU, D. PASCAL and S. LAVAL: Evidence for acceptor surface states in GaAs planar-type devices 1327

T. NEFFATI, G. N. LU and C. BARRET: Electrical characterization of Schottky diodes on very low energy ion-etched GaAs surfaces 1335

Notes

H. L. KWOK and W. C. WONG: A study of the sheet conductance profiles for recoil-implanted *n*-type silicon 1343

C. R. SELVAKUMAR, D. J. ROULSTON, S. C. JAIN and J. TSAO: Effective recombination velocity of low–high junctions 1346

Letters to the Editor

J. J. LIOU: Comments on "Theoretical $C(V)$ equation of an amorphous–crystalline heterojunction at low frequency" 1349

F. RUBINELLI: Reply to "Comments on theoretical $C(V)$ equation of an amorphous–crystalline heterojunction at low frequency" 1351

S. BANERJEE: Comments on "Effect of MS contact on the electrical behaviour of solar cells" 1353

Erratum I

NUMBER 9

S. R. DHARIWAL and D. R. MEHROTRA: On the recombination and diffusion limited surface recombination velocities 1355

VLADIMIR SZÉKELY and TRAN VAN BIEN: Fine structure of heat flow path in semiconductor devices: a measurement and identification method 1363

WEI-YE CHUNG and D. K. FERRY: Dynamic screening for ionized impurity scattering in degenerate semiconductors 1369

A. MARTY, J. JAMAI, J. P. VANNEL, N. FABRE, J. P. BAILBE, N. DUHAMEL, C. DUBON-CHEVALLIER and J. TASSELLI: Fabrication and d.c. characterization of GaAlAs/GaAs double heterojunction bipolar transistors 1375

S. R. DHARIWAL, V. N. OJHA and R. C. SHARMA: Voltage saturation at the high–low junction and its effect on the I–V characteristics of a diode 1383

A. AMBRÓZY: Variance of $1/f^{\gamma}$ noise 1391

S. WU, T. J. LETAVIC, R. J. GUTMANN and E. W. MABY: Lateral PIN diodes for silicon-on-insulator monolithic microwave integrated circuits 1397

SUDHA GUPTA, RAVDEEP KAUR, SURESH GARG and FEROZ AHMED: A general theory of an intensity-modulated beam method for determination of diffusion length, diffusion constant, lifetime, surface recombination velocity and absorption coefficient in a semiconductor material 1401

T. WADA, M. SUGIMOTO and T. AJIKI: Electromigration in bipolar *NPN* transistors 1409

AICHA ELSHABINI-RIAD, JIANQING HE, GARY LEE STIRK and SAMIRA AL-MAZROOH: Analytical model for leakage current in InGaAsP avalanche photodiodes 1413

WEN-YUEH JANG, CHUNG-YU WU and HONG-JEN WU: A new experimental method to determine the saturation voltage of a small-geometry MOSFET 1421

K. LEHOVEC and H. PAO: Built-in space charge at junctions between heavily doped and semi-insulating GaAs layers 1433

S. W. TARASEWICZ and C. A. T. SALAMA: Threshold voltage characteristics of ion-implanted depletion MOSFETs 1441

Z. IKONIĆ, V. MILANOVIĆ and D. TJAPKIN: On the design of tunable quantum well infrared photodetectors 1447

WALLACE WAN-LI LIN and CHIH-TANG SAH: Generation and annealing of interface traps on oxidized silicon irradiated by keV electrons 1451

Notes

S. T. TEH and D. G. S. CHUAH: Measurement of layers of submicron thickness with the aid of a microdensitometer 1461

K. J. NEGUS and D. J. ROULSTON: Simplified modelling of delays in the emitter–base junction 1464

J. G. SIMMONS and G. W. TAYLOR: Response to "Numerical simulation of an AlGaAs/GaAs bipolar inversion channel field effect transistor" 1467

Letter to the Editor

M. MEYYAPPAN, J. P. KRESKOVSKY and H. L. GRUBIN: Response to the comments by Simmons and Taylor 1469

Corrigendum I

SOFTWARE SURVEY SECTION III

NUMBER 10

A. K. GOEL: Electrode parasitic capacitances in self-aligned and deep-recessed GaAs MESFETs 1471

L. PAPADIMITRIOU, C. A. DIMITRIADIS and L. DOZSA: Trap centers in cuprous oxide 1477

A. V. GORBATYUK, I. V. GREKHOV and A. V. NALIVKIN: Theory of quasi-diode operation of reversely switched dinistors 1483

J. O. NYLANDER, U. MAGNUSSON, M. ROSLING and P. A. TOVE: Influence of silicon–sapphire interface defects on SOS MESFET behavior 1493

A. ORTIZ-CONDE, F. J. GARCÍA SÁNCHEZ, P. E. SCHMIDT and A. SA-NETO: The foundation of a charge-sheet model for the thin-film MOSFET 1497

S. K. LEE, J. H. CHEN, Y. H. KU, D. L. KWONG, B. Y. NGUYEN and K. W. TENG: Charge trapping and detrapping phenomena in thin oxide–nitride–oxide stacked films 1501

D. L. VASILYEVSKY, L. NÁNAI and R. VAJTAI: Perspectives of CdS–Cu_2S solar cells at high levels excitations 1505

S. K. LEE, Y. H. KU, D. L. KWONG and C.-O. LEE: Reliability study on rapid thermal processed metal–oxide–semiconductor field effect transistors 1509

ALLEN R. HEFNER JR and DAVID L. BLACKBURN: An analytical model for the steady-state and transient characteristics of the power insulated-gate bipolar transistor 1513

KER-WEN TENG and KUAN-YU FU: Characterization and analysis of drain-stress induced hot-carrier effects on NMOSFETs 1533

K. C. REINHARDT, A. SINGH and W. A. ANDERSON: Ytterbium metal–insulator–semiconductor contacts to indium phosphide 1537

J. J. LIOU and J. S. YUAN: A two-dimensional model for emitter–base junction capacitance of bipolar transistors 1541

ALAN H. MARSHAK: On the nonequilibrium carrier density equations for highly doped devices and heterostructures 1551

Notes

A. BUONOMO and C. DI BELLO: Space charge effect produced by dopant diffusion 1555

FRANÇOIS HÉBERT, ALAN G. SOLHEIM and DAVID J. ROULSTON: A V-groove emitter self-aligned bipolar technology 1558

K. P. GHATAK and M. MONDAL: On the photoemission from ultrathin films of *n*-Ge 1561

SOFTWARE SURVEY SECTION

TODSIP (Two-Dimensional Simulation Program of Submicro-scale GaAs MESFET), contributed by Xiong Si-Qiang I

NUMBER 11

MASAFUMI MIYAMOTO and TAKEAKI OKABE: Tradeoff between cutoff frequency and breakdown voltage for power MOSFETs 1563

S. KARMALKAR and K. N. BHAT: A simple C–V method to extract the correct equivalent box and the Gaussian representations of the channel-doping profile and the flat-band voltage of BC-MOSFETs 1567

HISHAM S. HADDARA and SORIN CRISTOLOVEANU: Parameter extraction method for inhomogeneous MOSFETs locally damaged by hot carrier injection 1573

A. SÖDERBÄRG, M. ROSLING, H. NORDE and P. A. TOVE: Determination of the mobility profile in silicon-on-sapphire material using the "fat" FET principle 1583

C. DONOLATO: Analysis of charge-collection efficiency measurements in Schottky diodes 1587

J. J. LIOU, H. K. BROWN and M. S. CLAMME: Characterization of reverse recovery transient behavior of bipolar transistors for emitter parameters determination 1595

SUNIL SHABDE, ANJAN BHATTACHARYYA, RON S. KAO and RICHARD S. MULLER: Analysis of MOSFET degradation due to hot-electron stress in terms of interface-state and fixed-charge generation 1603

M. MEYYAPPAN, G. ANDREWS and H. L. GRUBIN: Numerical study of an AlGaAs/GaAs heterostructure bipolar transistor: emitter design and compositional grading 1611

F. S. LAI: A generalized algorithm for CMOS circuit delay, power, and area optimization 1619

R. L. VAN MEIRHAEGHE, L. M. O. VAN DEN BERGHE, W. H. LAFLÈRE and F. CARDON: A study of the electrical and photovoltaic properties of magnetron sputtered Ti/*p*-InP Schottky barriers 1629

JESÚS A. DEL ALAMO and TAKASHI MIZUTANI: AuGeNi ohmic contacts to *n*-InP for FET applications 1635

Notes

P. CHATTOPADHYAY: A novel low resistive metal–insulator–semiconductor (MIS) inversion layer solar cell structure..... 1641

FRANÇOIS HÉBERT and DAVID J. ROULSTON: Silicon bipolar transistors with negative and positive current gain temperature dependence and output conductance on the same monolithic chip 1644

D. MISRA, C. R. SELVAKUMAR, E. L. HEASELL and D. J. ROULSTON: Effect of reactive ion etching on the electrical characteristics of poly-emitter bipolar transistors 1647

R. OVEN, D. G. ASHWORTH and S. AL-RAWI: Impurity redistribution during sublimation in UHV 1650

SOFTWARE SURVEY SECTION..... I

NUMBER 12

CHUNG-ZEN CHEN, SI-CHEN LEE and HAO-HSIUNG LIN: The hot electron effect in double heterojunction bipolar transistors: theory and experiment 1653

WŁADYSŁAW DĄBROWSKI and KAZIMIERZ KORBEL: Excess generation–recombination noise in reverse biased Schottky-barrier diodes..... 1657

EDMUND P. BURTE: The influence of annealing on the capacitance–voltage characteristics of metal/SIPOS/silicon capacitors..... 1663

K. F. KNOTT: Interface defects and induced voltage contrast in SEM studies of bare SiO_2–Si systems..... 1667

NOBUHIKO MUTOH and NOBUKAZU TERANISHI: New empirical relation for MOSFET $1/f$ noise unified over linear and saturation regions..... 1675

R. S. Popović and B. Hälg: Nonlinearity in Hall devices and its compensation 1681

S. Mijalković and N. Stojadinović: Efficient simulation of impurity redistribution in VLSI fabrication processes 1689

G. W. Taylor, P. M. Downey and J. G. Simmons: Electrical switching in the three terminal double heterostructure opto-electronic switching device—active layer contact 1695

S. Elnahwy and N. Adeeb: Analysis of the enhancement of the performance of a polysilicon solar cell due to simultaneous passivation of grain boundaries and back contact 1703

J. Belan: $1/f$ noise in GaAs ion-implanted resistance structures 1711

H. F. F. Jos: Bipolar transistor: two-dimensional effects on current gain and base transit time 1715

J.-S. Yuan and W. R. Eisenstadt: Circuit modeling of collector current spreading effects in quasi-saturation for advanced bipolar transistors 1725

S. Weiss and R. Kassing: Deep level transient Fourier spectroscopy (DLTFS)—A technique for the analysis of deep level properties 1733

Note

Yosi Shacham-Diamand: The separation of the generation components in an MOS capacitor made with photo-induced CVD oxide deposited at 80°C 1743

Letters to the Editor

Claudio Turchetti and Guido Masetti: Comments on "Modelling of a depletion-mode MOSFET" 1747

C. D. Parikh and J. Vasi: Response to "Comments on modelling of a depletion-mode MOSFET" 1749

Software Survey Section I